

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND STUDY

It is found that Malaysia's population increased from 8.2 million in 1960 to 29.95 million in 2014, which shows growth of 271% (Trading Economics). The significant increase in population leads to the increment of waste production, especially sewage sludge (Azman et al., 2013). After undergoing a few treatments processes in sewage treatment plant, the wastewater is reduced into sewage sludge where most of it is used as soil improver in agriculture field. However, there is still a portion of sewage sludge sent to landfill for decomposition process to take place.

Cement is the main material in casting concrete, where it acts as binder for the coarse and fine aggregates. According to Research and Markets, the cement production index grew at a Compound Annual Growth Rate (CAGR) of 4.4% from 2009 to 2013 and the cement production index grew another 6.6% in 2014. As the demand for cement increases yearly, the price of cement also continues to soar. Various efforts have been done in conducting research to seek out alternatives to replace cement. Among the numerous research conducted, it is found that sewage sludge ash could partially replace cement as it contains a high content of silica which is chemical compound that is also present in cement. According to past research, sewage sludge is compatible with cement and could be used to partially replace cement due to its pozzolanic properties (Marta 2010; Jamshidi et al., 2011). Not only that, it is also found that sewage sludge acts a good binder element in cement due to its high presence of silicon oxide after it undergoes combustion process (Rafiu et al., 2012).

As Malaysia continues to prosper, the amount of resident in Malaysia also rises. High population means more waste are produced. Waste management using landfilling method may not be effectively relevant. In 2008, there are already 230 number of landfill area in Malaysia (Idrus et al., 2008). It is expected that Malaysia may face scarcity of landfill area should there more innovative action taken to solve the problem. Therefore it is important for the authorities to improve the current state of landfilling practice and the authorities also must be careful in meeting all of the regulatory requirements when a landfill sitting evaluation is performed because majority of the current landfills in Malaysia practices poor code of landfill. One way of managing the excessive solid waste produced is by reusing them as it does not only preserve the environment of Malaysia, it also helps to reduce CO₂ emission as in the process of cement product, CO₂ will be released as a by-product.

1.2 PROBLEM STATEMENT

Malaysia is currently facing a crisis where the solid waste produced is piling up and cause a major environmental problem which significantly reducing our environment capacity to sustain life. In 2010, it is recorded that Kuala Lumpur State Territory generates 2000 tons of municipal solid waste per day where averagely a person produce 1.2 kg of waste a day (Budhiarta et al., 2012). Due to the increasing development and population in Malaysia, the amount of waste generated continues to hike and less than 5% are being recycled. The poor standards of waste management in Malaysia such as outdated and poor documentation of waste generation rates and its composition causes less than 5% of waste produced are recycled. The waste generation rate is expected to increase from 1.2 to 1.4 kg/capita/day in 2025, with the total increase of 3 million tons/day after calculating the effect of economic development, degree of industrialization and public habits (Sharifah & Latifah, 2013).

Besides, the cement demand is increasing drastically around the world as reported by Market Watch where global the cement consumption increases by 7.7% in 2013 and the cement consumption rose by another 2.6% in 2014 to 4140 Mega tonnes due to the phenomenon of China, which contributed a lot in the consumption of cement which is 59% out of the 4140 Mega tonnes in 2014. This is a serious issue as cement is

a non-renewable resource and it requires mining for limestone and shale which will endanger the ecosystem. Besides that, increasing cement demand means increasing production of cement which leads to the greenhouse effect phenomenon as production of cement releases greenhouse gas, which is CO_2 which is released during the production of clinker, a component of cement, in which calcium carbonate (CaCO_3) is heated in a rotary kiln to produce a series of complex chemical reactions (Gibbs et al., 2010).

1.3 OBJECTIVE

The main purpose of conducting this research is to discover the optimum curing method for concrete with partial replacement of SSA.

1. To investigate the effect of curing on SSA concrete
2. To compare the mechanical properties of SSA concrete by conducting Slump test, UPV, Compressive strength test and Flexural test

1.4 SCOPE OF STUDY

In this research, air dry curing, plain water immersion curing and salt water immersion curing are practiced in the concrete curing process. The sewage sludge used in this research is provided by Indah Water Konsortium. Sewage treatment plant located in Kuantan, Pahang whereas the salt water used is obtained from Teluk Cempedak in Pahang. As for the percentage of cement replacement by SSA, 10% replacement is chosen. The optimum temperature selected for incineration of sewage sludge is 800°C . The size of specimen is 100mm x 100mm for concrete cubes. The specimens are tested at the age of 3 days, 7 days, 28 days and 90 days. Tests to be carried out are compressive strength test, slump test, UPV test, 3-point flexural test.